CIP in 1999

International Potato Center
Annual Report 1999



In 1999, we decided to mark the passage of CIP and the Consultative Group on International Agricultural Research (CGIAR) into the new millennium by celebrating the potato: its origin and domestication in the Andes, its role in global food systems, and its promise for the future. A fully illustrated book with texts by outstanding historians, scientists, and journalists will serve as a special commemorative complement to this year's annual report to our stakeholders. This annual report will therefore be more concise than in the past, summarizing research highlights and providing a description of the financial and administrative standing of the Center in 1999. We trust that our readers will enjoy the visual and conceptual celebration of the potato, which will be available later this year.

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Gathering Forces to Meet Change

The passage into the year 2000 has brought with it—not coincidentally—a new vision of the global problem of hunger. The central role of poverty—how it defines a household's access to food and how it limits a community's options for improved productivity and economic growth—has become ever more evident. At the same time, it has become clear that there is no single means of resolving this most basic of human problems. The solutions must be holistic and flexible, with multiple components and participants. To be effective, they must address every sphere of human activity: the scientific, the political, the economic, the social, and the cultural.

In developing our 1998–2000 Medium-Term Plan, we narrowed the geographic scope of CIP's direct program involvement. Priorities were assigned to constraint-based research according to the expected benefits in the poorest countries or regions, with improvements in the remainder of the developing countries considered as spillover. The appropriateness of this strong poverty orientation was confirmed as our major financial stakeholders increasingly manifested their concern that CGIAR research should provide—first and foremost—benefits to the poor. CIP, in this way, has forged a seamless combination of approaches: a global research program addressing strategic research needs has been directly aligned with local, on-the-ground responses to opportunities and constraints in the areas where poverty has the strongest hold.

While CIP gathered forces to move forward with the challenges ahead, events in 1999 distinguished it as a year of contrasts. On the one hand, we saw new global projections give substance to what many of us had been arguing for some time: root and tuber crops have not received the attention they merit in the spectrum of international agriculture research. The joint IFPRI–CIP publication *Roots and Tubers for the 21st Century: Trends, Projections, and Policy Options for Developing Countries* summarizes the new data: "Projections suggest that global demand for roots and tubers will increase by 50 percent between 1993 and 2020 to reach 927 million metric tons, with 95 percent of the increase in utilization occurring in the developing world. Sub-Saharan Africa alone will account for more than two-fifths of the increase in demand." These projections have direct implications for CIP's mandate crops (see p. 12). In developing countries, the increase in demand for potato is projected at almost 110 percent; for sweetpotato, growth in demand is expected to be over 33 percent.

Recent studies have already shown these trends in action. Average annual growth rates in potato production during 1985–87 to 1995–97 in Ecuador (2 percent) and Peru (3.7 percent) were substantially higher than in previous decades. In developing countries as a whole, growth rates in potato production nearly doubled over the past 20 years, while the rates for other major commodities—such as maize, wheat, and rice—slowed. As potato output surged in Asia, sweetpotato continued to hold its ground, particularly in China, where these crops' contributions to local diets (potato) and use as animal feed (sweetpotato) have taken on remarkable dimensions.

As we witnessed the reaffirmation of the importance of our mandate crops in global food systems, however, we were confronted with sudden cuts in financing that may limit the scope of CIP's contributions in helping these crops achieve their full potential. By no means have roots and tubers been singled out in the trend of reduced funding for international agricultural research. Their already low relative position on the scale of global priorities, however, has made the reductions, which were felt by all, more critical.

In 1999, CIP's income dropped by 9 percent (see p. 16). This was the most drastic in a series of reductions that, since 1998, have resulted in restrictions of the Center's research program, particularly for potato. Faced with this dilemma, CIP management decided to meet the problem head-on, making carefully considered cuts and rapid restructuring decisions. This meant trimming an already lean Center even further by reducing staff in regional offices and at headquarters, particularly in the areas of market research, breeding, insect pest management, true potato seed, and administration.

Other changes did not involve reduction, but rather consolidation. We commissioned two external reviews to analyze Center-wide activities in natural resource management and participatory research and to boost their effectiveness and integration. Linkage to the CGIAR Organizational Change Program helped us to refine CIP's strategies, particularly in the area of knowledge management (see p. 13), and to give added momentum to our growing emphasis on team-building for research management and monitoring. Linkages to the CGIAR Gender and Diversity Program also opened pathways for fine-tuning the organization and ensuring that equity is not lost to efficiency.

Despite the general restrictions experienced in 1999, there were areas of growth that reflected ongoing confidence in CIP's capabilities for managing research. We were entrusted with the coordination of the CGIAR System-wide Initiative for Urban and Peri-Urban Agriculture (see p. 13), an activity that consolidates the collective knowledge of the CGIAR to coordinate and conduct research that could have a direct impact on the lives of urban and peri-urban populations. Our late-blight research program continued to grow—with advances that included the deployment of durably resistant varieties and the spread of the Farmer Field School program to Asia and Africa. The Global Initiative on Late Blight (www.cipotato.org/gilb.htm) proved its value as convenor of a wide range of capabilities and interests behind one major research theme. On the molecular front, we continued to advance with fingerprinting and the characterization of germplasm and diseases. The great adaptability of CIP's crops to emergency situations allowed us to continue to provide tools to rebuild agriculture in the wake of Hurricane Mitch and El Niño—and to respond to calls for urgent support from North Korea. CIP's strategies and methods for disease detection and control placed vital tools in researchers' and farmers' hands worldwide, while breeding and IPM work helped realize sweetpotato's potential as a source of food, feed, and raw material for industrial products. Perhaps more important, CIP helped confirm sweetpotato's promise in fighting vitamin A deficiencies in sub-Saharan Africa, thanks to the deployment of new varieties rich in beta-carotene (see p. 11).

In the area of natural resource management (NRM), CIP narrowed its focus to a few principal research objectives related to the Andean mountain region: identifying sustainable commodity management and land-use systems, protecting watersheds, and maintaining crop biodiversity (see p. 8). Several NRM research products are now being tested in development-oriented applications implemented by organizations in the region. This concurs with CIP's NRM research approach, which emphasizes the participation of members of CONDESAN, the Consortium for Sustainable Development of the Andean Eco-region (www.condesan.org) and the empowerment of community-level decision-makers. InfoAndina, the Latin American and Caribbean node of the Mountain Forum (www.mtnforum.org), plays an increasingly important role in generating the participation of these stakeholders by providing forums for information exchange, conferences, training, and project and consortium management.

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CONDESAN and CIP have also supported the Governments of Peru and other Andean countries in their preparations for the celebration of the Year of the Mountain, 2002. This yearlong series of global events will provide a unique opportunity to increase the profile of mountain regions worldwide, drawing attention to the need to counter the poverty and marginality that all too often characterize mountain populations. It will also foster understanding of the crucial role of mountains in safeguarding water resources as well as cultural and biological diversity, both of which are vital elements for future generations.

CIP received another vote of confidence when Bolivia, Canada, Ecuador, and Egypt—with the FAO and the UNDP as witnesses—signed a new agreement recognizing the Center's new legal status as an international organization (see p. 13). This was followed by the signing of a new host-country agreement with Peru. These agreements will greatly facilitate CIP's operations worldwide.

All of these accomplishments provide evidence of CIP's determination to ride with a fast-paced agenda and to continue to deliver. At the same time, the Center aims to quickly regain solid financial health and achieve a level of funding that will enable potato, sweetpotato, and other roots and tubers to contribute more to the global food basket. This is a time of change for CIP, and for the CGIAR system and international agricultural research as a whole. Despite the challenges that arise, CIP has demonstrated that—like its crops and their native mountain ecologies—it is versatile, it is resilient, and its full potential has yet to be tapped.

Hubert Zandstra
Director General

Research Overview

CIP's project-based research management approach, which devolved decision-making to CIP project teams, marked its second year in 1999. The new approach gave project leaders greater knowledge of day-to-day operations and—through their interaction with colleagues at national research organizations in developing countries—provided a natural mechanism for bringing CIP's research partners (see p. 24) into the process at an early stage.

Space does not permit a thorough description of all of CIP's research achievements during 1999—which will be published in detail in the 1999–2000 Program Report. The most significant results, summarized below, show the progress CIP has made in meeting the research milestones established as Center goals for the 1998–2000 period.

Sweetpotato: A Sleeping Giant

Recent updates in commodity analysis show the crop recovering some of the glory it lost with the demise of its role as a food supplement during World War II. Global production has increased steadily over the past five years, and CIP's recent analysis (see related publication on p. 20) indicates that in the near future sweetpotato will contribute more to the global food system as a source of starch and animal feed in Asia. It will also grow in importance as a source of vitamin A in Africa. The Center has designed specific materials to meet these objectives in both target markets.

Our work with commercial processors indicates that dry-matter increases of 25 percent or more will place sweetpotato in a highly competitive position against major sources of cereal-based starch and animal feed. Breeding for high dry-matter content in sweetpotatoes has been very successful at CIP. Improved germplasm that produces sweetpotatoes with 38 percent dry matter (versus the typical dry matter level below 30 percent) and disease resistance has been distributed and is now used in national breeding programs or evaluated on its own. Twenty-one promising clones are currently being tested in farm trials, and a group of high dry-matter and root-rot nematode-resistant clones developed by CIP in Indonesia are being used widely by Chinese breeding programs. CIP partners have also released a new cultivar in India.

These breeding programs have also been successful in incorporating molecular methods. The first amplified fragment length polymorphism (AFLP) linkage map was developed for an important African traditional cultivar, and transgenic plants have been produced that express the soybean trypsin-inhibitor gene, which may provide resistance to the sweetpotato weevil—the crop's most damaging pest worldwide.

Postharvest utilization of sweetpotato in Asia centers on the increased use of starch, flour, and vines for animal feed as well as new uses for fresh roots. An improved procedure for processing the starch of sweetpotato roots has been developed, and a new process for fermenting sweetpotato vines has increased protein content by 21 percent while reducing costs by half.

The most significant outcome, however, is the successful use of sweetpotato to address vitamin A deficiency in sub-Saharan Africa (see p. 11). Market research indicates that, with the right texture and flavor, orange-flesh sweetpotatoes are acceptable to sub-Saharan African consumers and can provide beta-carotene, the dietary precursor for vitamin A production. These varieties will be made more attractive to African farmers by incorporating resistance to weevils.

This market-oriented breeding work is accompanied by important improvements in crop management designed to further reduce product cost. CIP is collaborating in a global project to study sweetpotato decline caused by viruses. CIP has supplied virus antibodies as well as improved NCM-ELISA detection kits (see p. 21) to worldwide collaborators to ensure the use of consistent techniques.

This work is stimulated by the outstanding results achieved in collaborative work with Chinese colleagues, which indicated a substantial economic impact from the diffusion of virus-free sweetpotato planting material in Shandong Province. Between 1994 and 1998, this material was disseminated to

about 80 percent of the province's total sweetpotato area. Since then, the material has also been distributed in other important sweetpotato-producing provinces in China. As a result of this work, sweetpotato yield in China has increased by 30 percent (versus 3 percent worldwide). The estimated internal rate of return for this research and extension program is 202 percent, with a net present value of US$550 million.

Important results have been gleaned from CIP's IPM research in Cuba, Uganda, and Indonesia. Implementation of biological control–based integrated pest management (IPM) of the sweetpotato weevil in Cuba decreased storage root damage from more than 50 percent to less than 5 percent, while increasing yield by 30 percent. Results from a pilot project in Uganda indicated that farmers will only adopt IPM components if they generate short-term cash income. And monitoring and evaluation activities in Indonesia showed the potential impact of Farmer Field Schools for IPM of sweetpotatoes (see related training materials, p. 21). Preliminary results indicate increased net return due to higher yields and lower production costs. Results will be validated in 2000.

Controlling Potato Late Blight

Late blight of potato is a devastating disease worldwide. In developing countries, the lack of a winter period and the continuous presence of host plants create the ongoing disease pressure belied in late blight's name. Disease onset can be immediate after emergence. Under these conditions, the disease does not spread from isolated infection points, as in Europe and North America, but emanates en masse over large areas, moving at a devastating speed. Resource-poor farmers in East Africa, South and East Asia, and the Andean region are least likely to be able to afford the inputs necessary to control the disease with fungicide. Reaching and helping these farmers is the objective of CIP's late blight project. The strategy is to fight the disease by providing farmers and extensionists with control practices that can be customized for local conditions.

CIP is also developing and distributing potato germplasm with long-lasting resistance against all forms of the pathogen, learning more about the pathogen itself, and working directly with farmers to help them understand the disease (see p. 9). In 1999, CIP's resistant potato clones were distributed to many countries and performed well. Three late blight–resistant CIP-based varieties were released in Uganda and two in Peru.

CIP scientists also made significant progress in 1999 in the use of molecular tools to identify new sources of resistance and to facilitate transfer of the resistance to acceptable clones. At least one gene that may confer resistance has been isolated in a related species and cloned for creating transgenic plants carrying the resistance.

Increased knowledge of the late blight pathogen's ecology and evolution—gained through epidemiological and genetic studies in Latin America and Africa—is offering greater understanding of its newer forms as well as its emerging resistance to fungicide. This knowledge is critical in determining which control components should be used at each particular site.

Farmers are benefiting directly from CIP's efforts through the establishment of Farmer Field Schools, which were launched in seven countries in 1999 and now reach hundreds of farmers and their families. Farmers learn what causes late blight, a disease that is often attributed to excessive rainfall, sun, or mystical causes. They learn how to recognize the disease in its early stages and how to choose and use the best control methods for their local conditions. In the process, they further research progress by providing new information to scientists.

Integrated Control of Bacterial Wilt

The ELISA kit developed in 1998 to detect the bacterial wilt bacterium in potato tubers has been distributed to 24 countries, where it is used for seed certification and for quarantine and research purposes to support integrated disease management. In Southwest Asia, Farmer Field Schools are being used to orient farmers to aspects of integrated disease management for control of bacterial wilt and production of good quality seed. More than 200 farmers have attended the schools. The improved ELISA diagnostic tool (see related training materials on p. 21) also allowed increased emphasis in 1999 on characterizing germplasm for possible resistance. In Peru, 57 advanced clones were identified as having some resistance to bacterial wilt as well as desirable agronomic features. Eleven clones had less than 20 percent tuber latent infection. In wild species, accessions of 4 out of 8 species found to be resistant to wilt (*S. acaule, S. circaeifolium, S. limbaniense,* and *S. sawyeri*) did not harbor the bacteria in plant stems after greenhouse inoculation with race 3 of the pathogen.

Control of Potato Viruses

Many years of cooperation with The Sainsbury Laboratory (Norwich, UK) have laid the framework for improving clonal seed for resource-poor farm communities. A gene for resistance to potato virus Y has been located, isolated, and cloned for inserting into potato varieties through transformation. The Ry gene—known as the "resistance gene"—is unique in that it is naturally occurring in a species closely related to potato. A similar gene for resistance to potato virus X (PVX) has already been transferred to PVX-susceptible varieties through transformation. These varieties are now being evaluated to see if their resistance is sufficient to protect them against the virus. This development is of particular interest to poor farmers who depend on locally produced or stored seed tubers. Virus resistance will fortify these clonal seed sources and enable them to maintain resistance in the years ahead. This work may also reduce the need for seed producers to migrate to upper watershed areas in attempts to avoid the virus vectors. Such an effect would help protect important water-regulating mountain ecologies in tropical regions.

True Potato Seed (TPS)

Stable and consistent true potato seed hybrids are now available and being tested in many parts of the world. TPS offers alternatives to farmers without access to conventional high-quality seed tubers. It is also being used more and more as a rapid response technology for disaster mitigation and food production. In 1999, for example, CIP provided TPS on an emergency basis to North Korea and to the Caribbean countries devastated by Hurricane Mitch.

Unlike conventional seed tubers, TPS can be shipped easily and in small volumes, and management techniques can be taught quickly to farmers. Rapid food production is the result. CIP anticipates that the use of TPS for disaster mitigation and recovery will increase.

Natural Resources and the Environment

CIP's work in natural resources and the environment has focused on a few main objectives: developing tools for improving watershed analysis and the evaluation and planning of land-use systems; identifying the role of crop–livestock systems; limiting damage from seed production and chemical pest control in high-mountain ecologies; and developing technologies, policies, and approaches for enterprise development in market-oriented production and post-production activities. In the commodity area, this focus leads to rigorous research in the area of crop biodiversity to reduce dependence on toxic chemicals for crop production and to explore the potential use of biological processes for crop management. In general, CIP's natural resource management (NRM) work stresses the development and application of tools that identify the potential to reduce losses and protect the quality of the resource base (see *NRM at CIP* at www.cipotato.org/projects/nrm.htm).

In 1999, our work in the Andes continued to develop minimum data sets to improve natural resource conservation in the Andes, an approach that has been welcomed by natural resource management experts. In addition, two software prototypes for integrated assessment of agroecosystems were developed: a decision-support system for agriculture (the "tradeoff model") and an integrated multiscale assessment system ("SIMSRIG") based on GIS, remote sensing, and process-based models. The main constraints related to productivity, poverty reduction, and the use of natural resources in CONDESAN's benchmark sites were identified. As a part of CONDESAN's systems approach, quinoa varieties with tolerance to frost and drought in Andean production systems were developed. Further progress was made in identifying commercial markets for processed Andean root and tuber products such as arracacha sweets and freeze-dried olluco.

In the area of conservation and characterization of potato genetic resources, CIP's efforts to collect and safeguard *Solanum* species continue (see *Las Papas de Sudamérica*, p. 20) with 17 previously unavailable taxa of Peruvian *Solanum* collected in 1999. In conservation work, biodiversity surveys in communities in central Peru indicate a serious problem with genetic erosion of native potato cultivars. Communal seed banks are now being established to stem the erosion. Characterization and evaluation of native genetic materials continues. Twenty-three potato cultivars were identified as "drought-adaptive" and 15 native potato cultivars were identified as having desirable culinary qualities.

Outlook for 2000

There is no doubt that the research highlighted above is closely in line with the milestones CIP set for its 17 projects. While we expect further adjustment and consolidation in our research program during 2000, the results described above lay a solid foundation for applying technological change at the community level.

Integrated Disease Management: From the Lab to the Land

Rebecca Nelson is a molecular biologist who studies the population structure of the pathogen that causes late blight on potato, and the genetics of plant defense. She leads CIP's project on late blight, and her interest in integrated disease management has led her to be increasingly involved in "downstream" activities such as farmer education and participatory research.

Nelson spent the month of February 2000 in the village of Baños de Quilcate, in San Miguel province in the northern Peruvian department of Cajamarca.

Baños de Quilcate is one of 13 communities in the province in which CIP and CARE-Peru are collaborating on pilot Farmer Field Schools (FFS) for potato growers. Biweekly sessions combine learning activities with experiments conducted by farmers on issues of concern to them. The schools also serve as proving grounds for promising new potato varieties.

CIP has recently teamed up with other research and extension organizations to launch FFS programs in seven countries—Bangladesh, Bolivia, China, Ecuador, Ethiopia, Peru, and Uganda.

Nelson's hands-on experience with FFS began in 1994, when she worked at the International Rice Research Institute (IRRI) in the Philippines. She joined CIP in 1996, determined to test the FFS approach in potato. Below, she talks about what she learned during her month in the field.

Q. Why did you decide to spend a month in the mountains?
A. For the last three years my colleagues and I have been making short visits to the area during the field school season. But those trips have a high transaction cost. You spend a lot of time traveling for a little time in the field, and even then, you only get to see the most accessible sites. So you end up with an idealized view. I felt it was important to see the unabridged, unedited version.

Q. Were you pleased with what you saw?
A. Very much so. Of course, there are always things that could stand improvement. I had time not just to observe, but to help implement some changes. That's a rare luxury.

Q. What sorts of changes?
A. One example has to do with the way the field experiments were being conducted. The farmers always work in teams. To make things less complicated, the facilitators had decided to organize those teams according to the different fungicide treatments required by three of the four experiments. But by dividing the work that way, the farmers lost track of the point of the experiments. Each group should have been in charge of a single experiment, following it through the entire season, instead of taking responsibility for an isolated aspect of three.

It might seem like a small point, but a decision made on the basis of convenience was undermining the farmers' experience. I was able to call it to the attention of the facilitators, and help them get things back on track. It's critically important that the farmers understand why they're doing the experiments. The whole point is for them to take their findings and use them to make good decisions in their own fields.

Q. So much must depend on the extension workers.
A. They are really heroes. The time, the effort, the energy, the risks that they take—it's inspiring. San Miguel is a large area, and the roads went from bad to worse during the time we were there. It was raining every day, and the fog and mud were incredible. Just to arrive at a community at a given time can be a huge feat. I have a very high regard for people working day in and day out under those conditions.

And this is all new to them. They are trained in traditional extension work, and what we're trying do in the field schools is different. We've all had to learn a lot.

Q. Your training is as a laboratory scientist. Why are you so involved in the field schools?
A. My research is on plants and pathogens. Those are two legs of the so-called "disease triangle." The third leg is environment, and people are a huge part of that. In fact, when I draw the triangle, I always put people right in the middle. No matter what the problem is, farmers are the key to the solution.

S. GAMBOA

R. NELSON

Q. How did the farmers in the San Miguel area respond to late blight before they began taking part in the field schools?
A. One response was to stop planting at all in the wet season, when the late blight risk was simply too high. But the big problem with growing potatoes in the dry season is that yield depends on the availability of water. They also used fungicides, although not always very safely or effectively. They were generally familiar with the concept of resistant potato varieties but didn't have access to the best materials.

Q. Have the field schools given them access?
A. That's the idea. Starting two years ago, we introduced about a dozen varieties and breeding lines for testing in the field schools. Based in part on the farmers' results, two new varieties were released through the national seed distribution system.

This year the field schools are testing 50 more potato clones. Those represent the best selections from about 50,000 seedlings tested by CIP in its own fields. The farmers help decide which become varieties. They're also looking at a number of entries produced from true potato seed (seed taken from the berry of the plant)—a new concept for most of them.

Q. Are field schools essential to managing late blight, or are new varieties enough?
A. You need to know a lot in order to manage late blight—resistance, seed health, how the weather fits into the picture, and the epidemiology of the disease. You have to be able to predict how the disease will progress based on all those factors, and then you have to decide on a strategy. You can't get that knowledge to people just by diffusing improved seed. You have to improve knowledge together with seed. Field schools are the best way I know of to do that.

There is also the issue of the durability of resistance. We can get resistant varieties to farmers, but that's not the end of the story. Resistance has a long history of breaking down over time. Farmers have to know how to react if a crop they thought was resistant suddenly begins to show signs of a disease attack, and they have to have alternatives for the next season.

A good thing about the FFS approach is that farmers can decide what they want to know, and design experiments to provide answers. It's a liberating methodology in that sense.

Q. What are the most important gaps in farmers' knowledge about late blight?
A. One thing they don't know is that late blight is caused by a microbe. If you don't know that there's a microbe involved, you can't understand how the disease progresses. To use fungicides effectively you have to understand the idea of latent periods—the fact that the disease may be present at a given time, but not visible. Once farmers grasp that, they can be much better decision-makers.

They also don't know much about fungicides. I watched one group sit in a circle with the extension worker and talk about the difference between commercial names and active ingredients. It was very enlightening for the farmers. They said they were routinely mixing fungicides, but they admitted that they didn't really know what each one was meant to do. Sometimes they were just diluting the chemicals without realizing it.

Q. The field schools are meant in part to provide information for researchers. How good are the data being generated?
A. They're very useful. Chata Roja was universally selected as the preferred variety in eight communities last year—we had no reason to predict that, but the findings were unequivocal. This year the farmers are evaluating a set of 50 new breeding lines. We'll have results from 13 different locations. Those data will help us decide which are the most promising lines. Other experiments should help us improve computer simulation models we are developing to predict the way late blight will interact with certain environmental variables.

Another piece of data we get from the field schools is farmer opinion. How farmers respond to new varieties or new technologies is crucial to their success. Ideally, the field school is part of a feedback process, with farmers and researchers learning from one another.

Eradicating Childhood Blindness in Africa: The Promise of Orange-Flesh Sweetpotatoes

In sub-Saharan Africa, 3 million children under age five suffer blindness caused by lack of vitamin A. Vitamin A is produced by the body when it has sufficient quantities of a precursor known as "beta-carotene." When it doesn't, the body can not produce sufficient vitamin A, and blindness can result. The World Health Organization (WHO) says that women with vitamin A deficiency face a significantly higher risk of death during pregnancy. And children are more subject to falling victim to other diseases if they don't have enough of this critical vitamin.

World development agencies have reacted to this serious health crisis by distributing vitamin A capsules and fortifying food. The results have been impressive—more than 12 million children received vitamin A supplements in 1997, and the number of children suffering from blindness related to vitamin A deficiency has dropped significantly.

In spite of these heroic efforts, many families do not have access to the supplements. They live in remote areas where the infrastructure for wholesale distribution doesn't exist and are subject to further isolation from floods, landslides, and earthquakes, among other things. Transportation is sporadic, and it may take days to reach the nearest village.

CIP and its partner organizations have taken a different but complementary approach to fight vitamin A deficiency: the promotion of orange-flesh sweetpotato growth and consumption (see Hagenimana et al. in *Selected Publications*, p. 19). Orange-flesh sweetpotatoes contain high amounts of beta-carotene, which is largely responsible for the orange color of the flesh. This approach complements the development agencies' supplement/fortification approach; is accessible to isolated, small rural communities; and—most important—can sustain itself over time once it is implemented.

Recent studies involving CIP, the International Center for Research on Women (ICRW), and the Kenya Agricultural Research Institute (KARI) have shown that—contrary to past beliefs—orange-flesh varieties *are* acceptable to African consumers, especially children. The age-old preference of Africans for white-flesh sweetpotatoes is now known to be more related to the texture (dry and starchy) than to the color. Orange-flesh sweetpotatoes with a drier, starchier texture have now been developed that are appealing to local consumers in vitamin-A deficient areas and can be used for a variety of home- or community-produced local products, including cookies, cereals, rolls, and flour.

CIP ARCHIVES

Building on this new knowledge, CIP, ICRW, KARI, Makerere University-Uganda, NARO-Uganda (National Agricultural Research Organization), and EARO (Ethiopian Agricultural Research Organization) are developing a regional project to take advantage of sweetpotato's nutritional value. This ambitious five-year project—called *VITA*—aims to:

- increase the availability and acceptability of orange-flesh sweetpotatoes in sub-Saharan Africa
- complement development agencies' supplementation/fortification efforts
- increase the capacity of national agriculture, health, and nutrition experts to incorporate sweetpotatoes in their recommendations
- stimulate and promote microenterprise development using products from orange-flesh sweetpotatoes
- teach household managers (women and children) the nutritional value and effects of consuming orange-flesh sweetpotatoes and encourage them to analyze their household's nutrition.

Above all, the main objective of this project is to ensure that—by the end of the five-year project period—no child with access to the simple and common sweetpotato will ever suffer blindness or disease caused by vitamin A deficiency.

Roots and Tubers in the Global Food System: A Vision Statement to 2020

Root and tuber crops have complex roles to play in feeding the developing world in the coming decades. By 2020, more than two billion people in Asia, Africa, and Latin America will depend on these crops for food, feed, or income. Many of them will be among the poorest of the poor. Current decisions about research investment on root and tuber crops in the CGIAR (see p. 34)—and the strategy chosen for this research—will have profound implications for people around the world now and for decades to come. In a recent report co-published by CGIAR Centers CIP, CIAT, IFPRI, IITA, and IPGRI, the authors shed new light on the vision for these crops.

The adaptation of roots and tubers to marginal environments, their contribution to household food security, and their great flexibility in mixed farming systems, will make them an important component of strategies to help improve the welfare of the rural poor. At the same time, they will link smallholder farmers with emerging markets, providing a diversified range of high-quality, competitive products for food, feed, and industry.

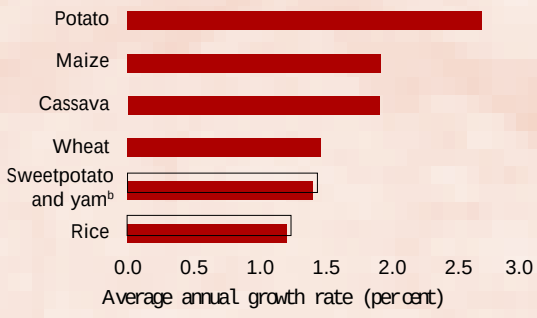
Many of the developing world's poorest and most food-insecure households look to these crops as a contributing if not principal source of food, nutrition, and cash income. Farm households see the value of roots and tubers in their ability to produce more edible energy per hectare per day than other commodities and in the fact that they produce under conditions where other crops may fail. In 1995–97, farmers in developing countries harvested 439 million metric tons of the major roots and tubers—cassava, potato, sweetpotato, and yam—with an estimated annual value of more than US$41 billion, nearly one-fourth the value of the major cereals.

The projections for roots and tubers reported on in this study were generated using the International Food Policy Research Institute's (IFPRI) IMPACT model and take into consideration the production of nearly all the major commodities in the global food system, including cereals, soybean, and meat. Roots and tubers' share of the total value of these products is projected to remain at roughly 11 percent.

The projected growth rates in output are particularly strong for potato (2.7 percent/yr) and yam (2.9 percent/yr). Production of cassava and sweetpotato will expand at a more modest pace—1.95 percent and 1.0 percent per year respectively. While these projected growth rates may appear high, they actually represent a considerable slowdown compared to recent rates of expansion for these crops. Nevertheless, future growth rates calculated for cassava, potato, and yam exceed those estimated for rice and wheat.

Given these findings, roots and tubers should remain an integral part of a global strategy to increase food production and utilization in Asia, Africa, and Latin America in the decades ahead. With a view to achieving the CGIAR's objectives of improving food security and eradicating poverty, and based on the Report's findings, representatives of the five CGIAR Centers that collaborated in this study have recommended mechanisms for more effectively capturing synergies among organizations working on roots and tubers.

Projected growth rates for major food crops in developing countries to 2020[a].



[a] With the average production for 1992–94 as the base period.
[b] Disaggregated growth rates for sweetpotato (1.0) and yam (2.9) are estimated outside IMPACT, but calculated based on those simulations.
Source: Scott, G., M.W. Rosegrant, and C. Ringler. 2000. Roots and tubers for the 21st century: Trends, projections, and policy options for developing countries. Food, Agriculture, and the Environment Discussion Paper No. 31. IFPRI-CIP, Washington, DC.

This summary is based on the CIP-CIAT-IFPRI-IITA-IPGRI report by G. Scott, R. Best, M. Rosegrant, and M. Bokanga, ***Roots and Tubers in the Global Food System: A Vision Statement to the Year 2020 Including Annex***, *a* report of the Committee on Inter-Centre Root and Tuber Crops Research (CICRTCR). The CICRTCR emerged from a recommendation of the 1996 CGIAR Inter-Centre Review of Root and Tuber Crops, and was established by CIP, CIAT, IFPRI, IITA, and IPGRI in 1996. The Committee aims to increase the efficiency of root and tuber crops research through collaborative research, knowledge enhancement, the mobilization of additional funding, and by linking organizations or individuals who work on root and tuber crops within or outside of the CGIAR.

In Brief

CIP Gets New Legal Status as International Center; Signs New Host-Country Agreement with Peru

Peruvian President Alberto Fujimori ratified a new host-country agreement with CIP, setting out the legal framework for operations from CIP's headquarters in Lima and confirming the Center's new legal status as an international organization, awarded through an international convention signed by five countries on 26 November 1999. The host-country agreement covers project site activities, funding arrangements, and regulations related to national and international staff. The international agreement—promoted and signed by the government of Peru and co-signed by Bolivia, Canada, Egypt, and Ecuador, along with honor witness UNDP—will facilitate logistics for establishing CIP research initiatives in developing countries worldwide. The latter agreement will remain open for signature through the end of 2001.

CIP Given Coordinating Role in CGIAR Urban and Peri-Urban Agriculture Initiative

A new CGIAR initiative coordinated by CIP will investigate ways to help urban farmers, a group that now comprises about 800 million people worldwide who tend home gardens or work in commercial livestock, aquaculture, forestry, or greenhouse operations. This number is expected to grow, since more than half of the world's population will live in urban areas by 2015, with eight of the nine fastest-growing cities in developing countries. The CGIAR System-wide Initiative for Urban and Peri-Urban Agriculture will link CIP and other CGIAR Centers with international aid agencies, nongovernmental organizations, and research networks in Latin America, Africa, and Asia to study agricultural issues associated with the continued growth in urban populations. Potential study sites include Accra (Ghana), Beijing (China), Bogota (Colombia), Dar es Salaam (Tanzania), Dhaka (Bangladesh), Harare (Zimbabwe), Lima (Peru), Lusaka (Zambia), Manila (Philippines), Maputo (Mozambique), and Yaunde (Cameroon). Research will focus on productivity as well as a range of environmental, health, economic, and public policy issues, including effects of water pollution on food quality, health risks of urban livestock production, and constraints in regulating informal markets.

CIP Helps Develop and Introduce New Potato Variety in Peruvian Market

The Peruvian market has a new table potato thanks to CIP and the Jerusalen de Porcon Cooperative in Cajamarca, Peru. The new variety, *Atahualpa*, is suitable for both baking and frying and produces an average of 30 metric tons per hectare. It is also resistant to late blight. The Jerusalen de Porcon Cooperative launched Atahualpa in October 1999 after six years of field trials to verify its quality, performance, and cost-efficiency. Development of the variety began in 1990, when the Cooperative received several late blight-resistant clones from CIP.

CIP Organizes Training Event for Potato Researchers from Central Asia and the Caucasus (CAC)

In October 1999, CIP and the Polish Plant Breeding and Acclimatization Institute (IHAR) organized a workshop and training course on potato germplasm management and potato seed production systems for 11 participants from Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. Training was conducted by Russian-speaking Polish scientists from the IHAR—a group of 6 research centers and 18 experimental farms under the direction of the Polish Ministry of Agriculture and Food Economy—at the Institute's Mlochow Research Center. Two scientists from Russia and Belarus served as Russian-speaking training facilitators. In addition to training on ware and seed potato production, breeding for resistance to pathogens, and screening for disease symptoms, participants learned about the requirements for ordering improved germplasm for evaluation in their respective countries. They were also given a tour of the planting, harvesting, sorting, and storage facilities at Zamarte Breeding and Seed Potato Production Station in northern Poland, considered one of the most modern potato breeding and seed-producing stations in Europe. The workshop was organized by CIP-ECA (see p. 33) as part of the CGIAR Collaborative Research Program for Central Asia and the Caucasus, a region where potato plays a leading food-security role. The Program was initiated and pioneered by ICARDA (see p. 35) to link CAC Republics in their efforts to upgrade their agricultural research base and refocus their agricultural economies for free-market conditions.

CIP Implements New Bioinformatics and Knowledge Management Systems

CIP's Bioinformatics Unit has developed a web interface to expand database access to the Center's regional offices, and a Workflow System to permit efficient tracking of all germplasm-related materials. The new interface will provide full access to CIP's Germplasm Database for CIP staff at headquarters and in the regions. The Workflow System, which will include a bar-coded labeling system for in vitro samples, applies the latest techniques of knowledge management and moves CIP into the vanguard in terms of CGIAR germplasm collection management.

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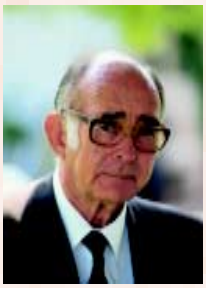
C. ATALAYA



With deep sadness, we report the death of Dr. Klaus Raven on 4 February 2000, after a short illness. Dr. Raven was a member of CIP's Board of Trustees from May 1982 through April 1988, and from September 1989 to the time of his death.

Dr. Raven was born in Hacienda Casa Grande, La Libertad, Peru. He was a graduate of the Escuela Nacional de Agricultura, La Molina (now the Universidad Nacional Agraria), where he obtained the degree of Ingeniero Agrónomo in 1954. He did his graduate studies at Texas A&M University (USA), where he obtained MS and PhD degrees in Entomology.

Although Dr. Raven initiated his professional career in the private sector as Head of the Department of Entomology of the Sociedad Nacional Agraria, Peru (1959 to 1966), for most of his professional life he was associated with the Universidad Nacional Agraria. He began his activities at that institution in 1960 as Professor of Entomology, a responsibility he maintained until his death. During his tenure at the Universidad Nacional Agraria, Dr. Raven provided leadership as the Director of Academic Affairs (Director de Enseñanza; 1969–1972), Vice-Rector (1974–1977), Entomology Department Head (1988–1989), and through various other director and coordinator roles in agricultural research on behalf of the University.

During Dr. Raven's two terms on CIP's Board of Trustees, he was Vice-Chairman of the Board, Chairman of the Audit Committee, Chairman of the Nominations Committee, and an active member of the Program Committee.

Dr. Raven was a man of integrity and rectitude who provided inspiration both to his colleagues and to his students. The CIP Board and the CIP community will miss Dr. Raven's sound advice, his balanced and constructive opinions, and—most of all—his friendship.

Donor Contributions

Donors (Ranked by level of contribution)	1999 (US$000)
Swiss Agency for Development & Cooperation (SDC)	$3,588
International Bank for Reconstruction and Development (IBRD/World Bank Group)	2,675
United States Agency for International Development (USAID)	2,323
Government of Japan	1,874
Government of Germany	1,524[a]
Danish International Development Agency (DANIDA)	1,148
Government of Netherlands	1,081[b]
Swedish International Development Cooperation Agency (SIDA)	848
United Kingdom Department for International Development, (DFID)	668
Canadian International Development Agency (CIDA)	619
Government of Austria	485
International Fund for Agricultural Development (IFAD)	453
Government of Luxembourg	400
International Development Research Centre (IDRC), Canada	370
Government of France	229[c]
International Livestock Research Institute (ILRI)	213
Asian Development Bank (ADB)	182
Australian Centre for International Agricultural Research (ACIAR)	180
Government of Italy	145
Government of Norway	127
Government of China	120
The Royal Veterinary and Agricultural University (KVL), Denmark	110[d]
Consultative Group on International Agricultural Research (CGIAR)	95[e]
Government of the Islamic Republic of Iran	80
Natural Resources Institute (NRI), United Kingdom	60
Government of Korea	60
Government of Brazil	50
Rockefeller Foundation, USA	50
Government of Spain	50
Government of South Africa	50
International Fertilizer Development Center (IFDC)	49
Organization of Petroleum Exporting Countries (OPEC) Fund for International Development	45
Government of India	38
The McKnight Foundation, USA	34
Michigan State University, USA	34
International Development Bank (IDB)/Regional Fund for Agricultural Technology (FONTAGRO)/International Network of Production Systems Research and Methodology (RIMISP)	33
CGIAR Impact Assessment and Evaluation Group (IAEG)	20
Government of Mexico	15
United Nations Environment Programme (UNEP)	15
United States Department of Agriculture (USDA)	5
Total	**$20,145**

[a]Includes $40,000 for associate experts. [b]Includes $60,000 for associate experts. [c]Includes one scientist-year from IRD. [d]Includes $100,000 for associate experts. [e]Includes $80,000 for germplasm conservation, adaptation, and enhancement for diversification and intensification of agricultural production in Central Asia and the Caucasus, and $15,000 for impact evaluation of participatory development of integrated insect and disease management for the potato crop in San Miguel, Peru.

CIP benefits from the confidence and support of a number of dedicated donors. A substantial proportion of CIP's funding is unrestricted and broadly underpins the Center's capacity to respond effectively to needs and opportunities. This is by far our most valuable source of financial support and CIP is thankful for the determination of core donors to uphold the principles on which the CGIAR was founded. Other funds come through competitive grants for specific projects or initiatives. These contributions are limited in time and scope, and carry high additional transaction costs.

Recent trends show worrisome decline in international agricultural research funding as a whole. This instability is challenging the CGIAR system and its Centers to forge new strategies and directions. CIP continues to seek new partners who share its belief that strategic, high-quality agricultural research plays a major role in alleviating hunger, poverty, and environmental degradation in the world's poorest countries.

Finances

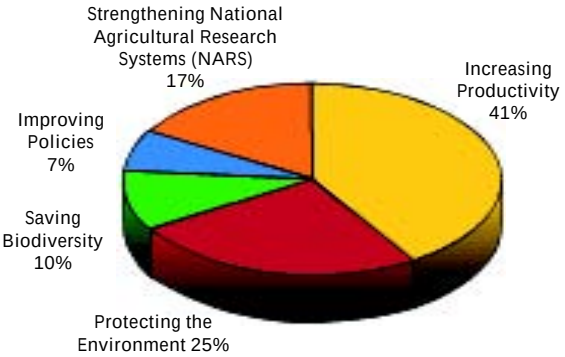
CIP is placing a high priority on rebuilding its Operating Fund, strengthening its cash-management strategies, and increasing its ability to borrow on short notice and on favorable terms.

The Center's total income in 1999 was $21.4 million, 9 percent below 1998 income of $23.4 million. This income was distributed as follows: Unrestricted, US$11.2 million; Restricted, US$8.6 million; and Other Income, US$1.6 million. It should be noted that at the end of 1999, US$1.2 million (5.6 percent) of the Center's expected income was not yet received.

The European Union (EU) 1999 administrative funding failure reduced CIP's income by US$1.9 million. Because of the resulting $1.3-million deficit, the Center's Operating Fund for 1999 dropped to US$0.2 million, equivalent to only 3.3 working days. The CGIAR Finance Committee's allocation to partially compensate this default will be US$1.4 million. This amount will be received in 2000. To ensure continued Center operations, the entire amount will have to be deposited in CIP's Operating Fund, increasing it to the equivalent of 25 working days.

The first phase of the Biodiversity Complex was completed in June 1999. This corresponded to an investment of US$0.25 million (for construction) and US$0.15 million (for equipment) provided by restricted contributions from the Government of Japan. Due to unexpected reductions in Center income and subsequent cash-flow limitations, the second phase could not be continued. This phase should be reinitiated in 2000.

CIP has improved its cash-flow situation considerably during the past four years through careful financial management, but this area remains a problem during periods when donor fund disbursements are delayed. Therefore, the Center is placing a high priority on rebuilding its Operating Fund, strengthening its cash-management strategies, and increasing its ability to borrow on short notice and on favorable terms.



Funding by CGIAR Undertaking

Balance Sheet (US$000) Year ending 31 December 1999	**1999**	**1998**
Current Assets		
Cash and short-term deposits	$ 8,392	$ 5,438
Securities	57	56
Accounts receivable:		
Donors	1,170	4,260
Employees	63	269
Other	426	461
Inventories	607	701
Prepaid expenses	327	361
Total	11,042	11,546
Loans to Employees	137	207
Fixed Assets		
Property, plant, and equipment	23,525	22,893
Less accumulated depreciation	(13,024)	(12,639)
Total	10,501	10,254
Total Assets	**$21,680**	**$22,007**

Balance Sheet (US$000) Year ending 31 December 1999	**1999**	**1998**
Current Liabilities		
Advances from donors	$ 3,262	$ 2,150
Accounts payable:		
Research contracts and organizations	4,277	4,138
Suppliers and taxes	493	708
Provisions for severance indemnities	61	47
Total	8,093	7,043
Accruals and Provisions	1,030	991
Net Assets		
Capital invested in fixed assets	10,501	10,254
Capital fund	1,855	2,191
Operating fund	201	1,528
Total	12,557	13,973
Total Liabilities and Net Assets	**$21,680**	**$22,007**

Funding Allocation by CIP Program Area (in US$ millions)

	1999		1998	
	Estimated	Percentage	Actual	Percentage
Potato	$14.2	65%	$14.7	64%
Sweetpotato	5.1	23	5.1	22
Andean Roots and Tubers	0.8	4	0.7	3
Natural Resource Management	1.2	5	1.6	7
Global Mountain Program	0.4	2	0.8	3
Global Initiative for Late Blight	0.1	0	0.1	1
Urban and Peri-Urban Agriculture	0.2	1	0.0	0
Total	**$22.0**	**100%**	**$23.0**	**100%**

The balance sheet and funding allocation tables summarize CIP's finances in 1999. A complete, audited financial statement by Pricewaterhouse-Coopers is published separately and can be requested from the Chief Financial Officer (cip-cfo@cgiar.org).

CIP Financial Information System (CIPFIS)

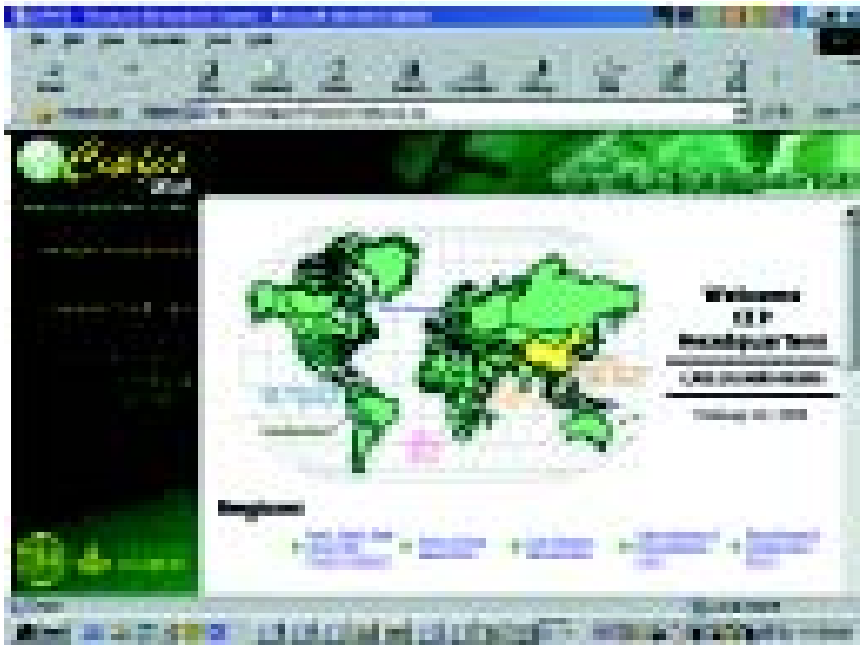
The CIP Financial Information System (CIPFIS) is a project-based integrated budgeting, accounting, costing, and cash-management system. The system was introduced in 1993. Since then, it has been upgraded and updated from a Clipper-Microsoft Visual FoxPro 5 version to a new version released in December 1999. It comprises an SQL-Server database and three different front-ends: an online integrated application, an offline posting system and a Web-based reporting and monitoring tool implemented with Active Server Pages (ASPs).

The application, installed at CIP headquarters in Lima, offers a full range of data-editing and reporting facilities corresponding to various levels of user-access. The offline posting system was developed for decentralized input from remote sites to the central CIPFIS database.

The payroll is linked electronically with CIPFIS, thus eliminating the need for manual entries. Inventory items are entered into the Logistics system, and values of receipts are entered from suppliers' invoices. The Logistics and CIPFIS databases are fully integrated.

One feature of CIPFIS data entry is the ability to scan original documentation supporting an entry and to link it to the entry within the system. This enhances the drill-down capability of the system, as the user can see a copy of the original documentation. The user is then able to verify information in considerable detail. This auditing function improves the overall accuracy of information and enables errors to be spotted more easily.

The overall result is a powerful reporting tool that has proved to be effective for decision-making and funding allocation as well as budget monitoring. The new CIPFIS system facilitates the analysis of data considerably and provides an up-to-the-minute but conservative view of the Center's cash situation.



Selected Publications

This list includes selected publications authored or edited by CIP staff during 1999. For more information about books, proceedings, research articles, and working papers published by CIP staff, please contact the CIP Library (cip-library@cgiar.org) or check the Library section of the CIP website.

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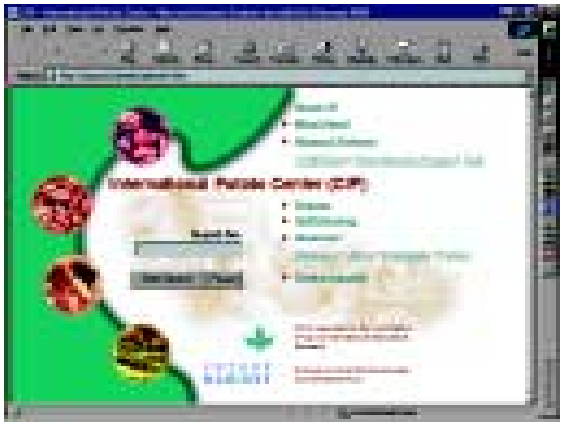
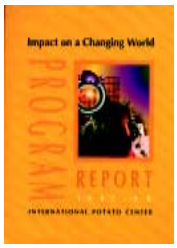
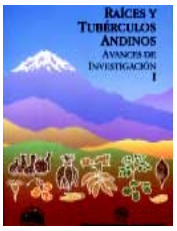
CIP Publications





Impact on a Changing World: 1997–98 Program Report. *CIP. 1999. Softbound. 457 p*. CIP's 1997–98 Program Report presents initial progress reports for the Center's 17 newly created research projects. Forty-six reports are grouped into five general areas: Potato, Sweetpotato, Potato and Sweetpotato, Natural Resource Management in the Andes, and Andean Roots and Tubers. The Report's feature article, "Incorporating Poverty in Priority Setting: CIP's 1998–2000 Medium Term Plan," describes how CIP research project proposals are evaluated by a priority-setting mechanism that measures project potential for poverty alleviation.

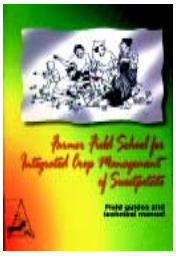
Sweetpotato Facts: A Compendium of Key Figures and Analysis for 33 Important Sweetpotato-Producing Countries. *CIP. 1999. Brochure. Revised. (Available in English and Spanish*.) This brochure contains revised data on annual sweetpotato production, area, yield (1995–97) as well as on utilization, per capita consumption, and feed use (1994–1996); it includes estimates of annual average growth rates in sweetpotato production, area, and yield 1961–63 to 1995–97 and 1985–87 to 1995–97 on a country and regional basis. It also contains the crop's national ranking among the major food crops produced in developing countries and selected socioeconomic indicators (e.g., population, urban population, GNP per capita and annual average growth rates) for 33 important sweetpotato-producing countries.



Raíces y Tubérculos Andinos: Avances de Investigación, Tomo I. *CIP-CONDESAN. 1999. T. Fairlie, M. Morales Bermúdez, and M. Holle (eds.). 241 p.* This joint publication by CIP-CONDESAN includes extensive information on Andean root and tuber crop genetic resources, characterization and conservation, and production and consumption. It is the first of two volumes disseminating the results of the Collaborative Program for the Conservation and Use of Andean Roots and Tubers. The crops covered in this study, although common in the fields of the Andean highlands, have rarely been the subject of systematic research.

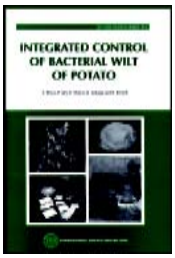
Las Papas de Sudamérica: Peru. *C. Ochoa. CIP. 1999. illust. Hardback. 1036 p.* CIP taxonomist Carlos Ochoa summarizes his 30-year exploration throughout Peru for wild relatives of *Solanum tuberosum*, commonly known as the potato. Published with the economic support of Calbee Potato of Japan and the Istituto Agronómico per L'Ultramare (IAO) of Italy, this book contains a thorough description of nearly 100 wild *Solanum*. Two-thirds of the species described in the book—almost 50 percent of all wild potato species known to exist in the Americas—were discovered and classified by the author himself. To complete this monumental work, Ochoa examined more than 4000 holdings of Peruvian wild potatoes in herbariums in the United States, Europe, and South America, including his own personal collection. Ochoa describes the genetic gold-mine these hardy wild species represent as a source of desirable traits for breeding new varieties with higher resistance to pests and disease. "Because of the great diversity and genetic potential of the Peruvian wild species—many of which still have not been evaluated for their potential use in horticulture—the opportunities for future research in genetics improvement seem infinite," he says. This is the second volume in Ochoa's series on the potatoes of South America. The first, *Potatoes of South America: Bolivia*, is considered one of the most complete references on Bolivian potato species.

CIP Training Materials



Farmer Field School for Integrated Crop Management of Sweetpotato. *E. van de Fliert and A.R. Braun. CIP. 1999. Field Guides and Technical Manual. 266 pages. Available in English and Indonesian.* This training manual, produced for Farmer Field School (FFS) facilitators, describes the FFS-Integrated Crop Management (ICM) approach for sustainable sweetpotato cultivation. The material includes an introduction to the FFS-ICM methodology, field guides, and technical guidelines for everything from soil preparation to sweetpotato marketing and processing. A related training video, *Learning Integrated Crop Management for Sweetpotato*, describes the common constraints faced by Indonesian sweetpotato farmers and promotes the use of the FFS-ICM approach to identify appropriate solutions. Originally produced in Indonesian, the video is also available in English in PAL/NTSC-VHS formats.

Molecular Biology Laboratory Protocols: Plant Genotyping. *CIP Crop Improvement and Genetic Resources Department. 1999. 2nd edition. Revised. 38 pages. Available in English and Spanish.* This manual describes plant genotyping protocols that have been used at CIP's Molecular Biology Laboratory. This includes plant DNA extraction, plasmid extraction, PCR amplification of plasmid inserts, non-radioactive RFLP analysis, random amplified polymorphic DNA, single-sequence repeats, amplified fragment length polymorphism, DNA gel electrophoresis, and TAQ polymerase purification.



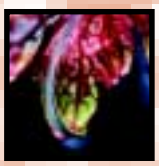
Integrated Control of Bacterial Wilt of Potato. *S. Priou, P. Aley, E. Chujoy, B. Lemaga, and E. French. 1999. CIP Slide Training Series IV-3. Slideset (57 slides) and Guide (30 pages). Available in English and Spanish.* Bacterial wilt—also known as "potato brown rot"—is caused by the *Ralstonia solanacearum* bacterium, which affects more than 30 plant species and is the second most important constraint to potato production in tropical and subtropical regions. Spread of the pathogen has been associated with dissemination via latently infected planting material. These training materials present elements of pathogen detection, disease symptomatology, and epidemiology as well as control components, and are intended for use in training national potato program staff on the integrated management of bacterial wilt in developing countries.

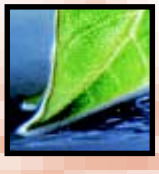
Producción de Tubérculos-Semillas de Papa. *O.A. Hidalgo, (ed.). CIP. 1999. 2nd edition. Training Manual. 293* pages. A training manual composed of 26 sections addressing the most important topics related to the production and handling of high-quality potato seed tubers. The manual is aimed for use in the training of potato technologists and practitioners involved in the different phases of a potato seed production program, as well as in the organizational and managerial aspects of alternative seed supply schemes.

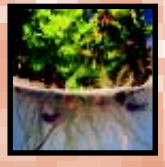
NCM ELISA Kit: Instructions for Detecting *Ralstonia solanacearum* in Potato. *CIP. 1999. Video (NTSC, 37 minutes) and Instruction Manual (25 pages). Available in Chinese, English, and Spanish*. This set of training materials includes an instruction video and manual on the use of CIP's kit for NCM-ELISA (enzyme-linked immunosorbent assay on nitrocellulose membrane using enriched samples). The kit can be used for detection of the bacterial wilt pathogen *R. solanacearum* in latently infected potato tubers—essential for producing and maintaining high-quality seed production systems. It can also be used for varietal evaluation of bacterial wilt resistance or for disease epidemiology research.

For more information on CIP training materials or curriculum (see p. 22) please contact CIP Training (cip-training@cgiar.org) or check the Training Section of the CIP website.

Research Partners







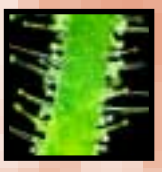
Africa

• AFRICARE, Uganda • AGERI Agricultural Genetic Engineering Research Institute, Egypt • Agricultural Research Council, South Africa • Agricultural Research Institute, Tanzania • AHI African Highlands Initiative • Angola Seeds of Freedom Project • Arapai College, Uganda • ARC Agriculture Research Center, Egypt • ASARECA Association for Strengthening Agricultural Research in Eastern and Central Africa • Awasa Research Centre, Ethiopia • Bvumbwe Research Station, Malawi • CPRA Centre de Perfectionnement et de Recyclage Agricole de Saïda, Tunisia • EARO Ethiopian Agricultural Research Organization (formerly IAR) • ESH Ecole Supérieure d'Horticulture, Tunisia • IAV Institut Agronomique et Vétérinaire Hassan II, Morocco • INERA, Institut Nationale d'Etudes et de Recherches Agricoles, D.R. Congo • INRA Institut National de la Recherche Agronomique, Morocco • INRAT Institut National de la Recherche Agronomique de Tunisie • IRA Institut de Recherche Agronomique, Cameroon • ISABU Institut des Sciences Agronomiques du Burundi • JKUAT Jomo Kenyatta University of Agriculture and Technology, Kenya • KARI Kenyan Agricultural Research Institute • Makerere University, Uganda • Ministry of Agriculture, Eritrea • MSIRI Mauritius Sugar Industry Research Institute • NAARI Namulonge Agricultural and Animal Research Institute, Uganda • NARO National Agricultural Research Organization, Uganda • PPRI Plant Protection Research Institute, Egypt • PRAPACE Programme Régional de l'Amélioration de la Culture de la Pomme de Terre et de la Patate Douce en Afrique Centrale et de l'Est • SARRNET Southern Africa Root Crop Research Network • SHDI Self-Help Development International, Ethiopia • TFNC Tanzania Food and Nutrition Centre • University of Asmara, Eritrea • University of Nairobi, Kenya

Asia and the Pacific

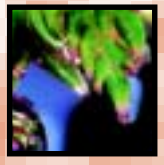
• AARI Aegean Agricultural Research Institute, Turkey • AIT Asian Institute of Technology • AREA Agricultural Research and Extension Authority, Yemen • ASPRAD Asian Sweetpotato and Potato Research and Development • BARI Bangladesh Agricultural Research Institute • Benguet State University, Philippines • BRC Biotechnology Research Center, Vietnam • CAAS Chinese Academy of Agricultural Sciences • CAF College for Agriculture and Forestry, Vietnam • CARE-Bangladesh • Cendrawasih University, Indonesia • Chiang Mai University, Thailand • China Agricultural University • CIAD Center for Integrated Agricultural Development, China• CNCQS Chinese National Centre for Quality Supervision and Test of Feed • CPPI Chongqing Plant Protection Institute, China • CPRI Central Potato Research Institute, India • CRIFC Central Research Institute for Food Crops, Indonesia • CRIH Central Research Institute for Horticulture, Indonesia • CTCRI Central Tuber Crops Research Institute, India • Department of Agriculture, Phichit Horticultural Research Center, Thailand • DRCFC Dalat Research Center for Food Crops, Vietnam • FAO Community IPM Program, Vietnam and Indonesia • Food Crop Research Institute, Vietnam • GAAS Guangdong Academy of Agricultural Sciences, China • HAU Hanoi Agriculture University, Vietnam • HKU Hong Kong University • HORDI, Horticultural Research and Development Institute, Sri Lanka • HUAF Hue University for Agriculture and Forestry, Vietnam • Hung Loc

Agriculture Research Center, Vietnam • ICAR Indian Council of Agricultural Research • IPB Bogor Agriculture University, Indonesia • JAAS Jiangsu Academy of Agricultural Sciences, China • MARDI Malaysia Agriculture Research Development Institute• MARS Mwara Agricultural Research Institute, Indonesia • Mianning Agriculture Bureau, China • Mitra Tani, Indonesia • MMSU Mariano Marcos State University, Philippines • Nagoya University, Japan • Nanchong Agricultural Research Institute, China • National Institute of Animal Husbandry, Vietnam • NOMIARC Northern Mindanao Agricultural Research Center, Philippines • NPRCRTC Northern Philippine Root Crops Research and Training Center • NPRP National Potato Research Program, Nepal • NUS National University of Singapore • PCARRD Philippine Council for Agriculture and Resources, Research and Development • PDP Potato Development Program, Nepal • PPD Plant Protection Department, Vietnam • PRCRTC, Philippine Root Crop Research and Training Center • PRP Potato Research Programme, Nepal • PSPDP Pakistan-Swiss Potato Development Program • RDA Rural Development Agency, Korea • RIFCB Research Institute for Food Crops Biotechnology, Indonesia • RILET Research Institute for Legumes, Root and Tuber Crops, Indonesia • RIV Research Institute for Vegetables, Indonesia (formerly LEHRI) • SAAS Shangdong Academy of Agricultural Sciences, China • SAAS Sichuan Academy of Agricultural Sciences, China • SARIF Sukamandi Research Institute for Food Crops, Indonesia • SEARCA Southeast Asian Regional Center for Graduate Studies and Research in Agriculture, Philippines • SPPC Centro de Investigación de Semilla de Papa, Yemen • TARI Taiwan Agricultural Research Institute • TCRC Tuber Crop Research Center, Bangladesh • University of the Philippines–Los Baños • UPM University Putra Malaysia • UPWARD User's Perspective with Agricultural Research and Development, Philippines • VASI Vietnam Agriculture Science Institute • ViSCA Visayas College of Agriculture, Philippines • XSPRC Xuzhou Sweet Potato Research Center, China • YPPP Yemeni Plant Protection Project • YPPSE Foundation for Socio-Economic Development, Indonesia • Yunnan Agricultural University, China

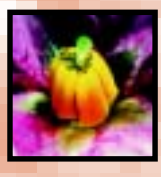


Europe

• AB-DLO Institute for Agrobiology and Soil Fertility, Netherlands • ARCS Austrian Research Centers Seibersdorf • BBA Federal Biological Research Centre for Agriculture and Forestry-Institute for Biological Control, Germany • CABI Bioscience, UK • CIRAD Centre de Coopération Internationale en Recherche Agronomique pour le Développement, France • CPRO-DLO Centre for Plant Breeding and Reproduction Research, Netherlands • CRP-CU Centre de Recherche Public Gabriel Lippmann, Luxembourg • ENEA Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative, Italy • GLKS Institute of Plant Genetics and Crop Plant Research, Germany • IAC International Agricultural Centre, Wageningen, Netherlands • IAO Istituto Agronomico per l'OItremare, Italy • IBC Institute for Breeding of Crop Plants, Federal Center for Breeding Research on Cultivated Plants (Bundesanstalt für Züchtungsforschung an Kulturpflanzen), Germany • IHAR Polish Plant Breeding and Acclimatization Institute • INIA Instituto Nacional de Investigaciones y Tecnologia Agraria y Alimentaria, Spain • INRA Institut National de la Recherche Agronomique, France • IPO-DLO Institute for Plant Protection, Netherlands



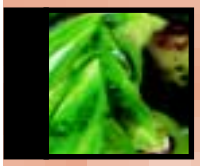
Netherlands • IPR Institute for Potato Research, Poland • IRD Institut de Recherche pour le Développement (formerly ORSTOM), France • IZ Instytut Ziemniaka, Poland • MAE Ministère des Affaires Etrangères, France • MPB Cologne, Germany • MPIBR Max Planck Institute for Plant Breeding Research, Germany • N.I. Vavilov Institute, Russia • Nijmegen University, Netherlands • NRI Natural Resources Institute, UK • PGS Plant Genetic Systems, Belgium • Rothamsted Experiment Station, UK • The Sainsbury Laboratory, UK • SCRI Scottish Crop Research Institute • University of Birmingham, UK • University of Göttingen, Germany • University of Hohenheim, Germany • University of Kassel, Germany • University of Kiel, Germany • University of Naples, Italy • University of Tübingen, Germany • Wageningen University, Netherlands



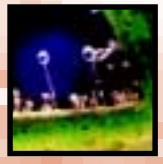
USA and Canada

• Clemson University, USA • Cornell University, USA • Louisiana State University, USA • McMaster University, Canada • Mississippi State University, USA • Montana State University, USA • Michigan State University, USA • North Carolina State University, USA • NRSP-6 USDA Potato Production Introduction Station–Wisconsin • Ohio State University, USA • Oregon State University, USA • Plant Gene Expression Center, University of California-Berkeley, USA • Potato Research Centre, Agriculture and Agri-Food, Canada • SPI Smart Plant International, USA • University of Georgia, USA • University of Minnesota, USA • University of Missouri, USA • University of New Brunswick, Canada • University of Wisconsin, USA • USDA United States Department of Agriculture • USVL United States Vegetable Laboratory

Latin America and the Caribbean



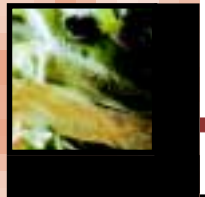
• ARARIWA Association for Andean Technical- Cultural Promotion, Peru • ASAR Asociación de Servicios Artesanales y Rurales, Bolivia • CARDI Caribbean Agricultural Research and Development Institute, Trinidad • CARE-Peru • CBC Centro Bartolomé de las Casas, Peru • CECOACAM Central de Cooperativas Agrarias de Cañete y Mala, Peru • CEMOR Cemor Editores & Promotores, Peru • Centros de Reproducción de Entomógenos y Entomopatógenos, Cuba • CIAAB Centro de Investigaciones Agrícolas A. Boerger, Uruguay • CICA Centro de Investigación en Cultivos Andinos, Peru • CIED Centro de Investigación, Educación y Desarrollo, Peru • CIRNMA Centro de Investigación de Recursos Naturales y Medio Ambiente, Peru • CLADES Consorcio Latinoamericano de Agroecología y Desarrollo, Peru • CNPH Centro Nacional de Pesquisa de Hortaliças, Brazil • CONDESAN Consortium for the Sustainable Development of the Andean Ecoregion • Consorcio Surandino • CORPOICA Corporación del Instituto Colombiano Agropecuario • Dirección Nacional de Sanidad Vegetal, Cuba • EMBRAPA Empresa Brasileira de Pesquisa Agropecuária, Brazil • Empresas de Cultivos Varios del Ministerio de Agricultura, Cuba • FONAIAP Fondo Nacional de Investigaciones Agropecuarias, Venezuela • FORTIPAPA Fortalecimiento de la Investigación y Producción de Semilla de Papa, Ecuador • Fundación PROINPA Promoción e Investigación de Productos Andinos, Bolivia • FUNDAGRO Fundación para el Desarrollo Agropecuario, Ecuador • IAN Instituto Agronómico Nacional, Paraguay • IASA Instituto Agropecuario Superior Andino, Ecuador • IDEA Instituto Internacional de Estudios Avanzados, Venezuela



• IESR/INTA Instituto de Economía y Sociología Rural del INTA, Argentina • IIN Instituto de Investigación Nutricional, Peru • IMA Instituto de Manejo de Agua y Medio Ambiente, Peru • INIA Instituto Nacional de Investigación Agraria, Peru • INIA Instituto Nacional de Investigaciones Agropecuarias, Chile • INIA Instituto Nacional de Investigaciones Agropecuarias, Uruguay • INIAP Instituto Nacional de Investigaciones Agropecuarias, Ecuador • INIFAP Instituto Nacional de Investigaciones Forestales y Agropecuarias, Mexico • INIVIT Instituto Nacional de Investigación de Viandas Tropicales, Cuba • INTA Instituto Nacional de Tecnología Agropecuaria, Argentina • Jerusalen de Porcon Cooperative, Peru • MIP Programa de Manejo Integrado de Plagas, Dominican Republic • PICA Programa de Investigación de Cultivos Andinos • PICTIPAPA Programa Internacional de Cooperación del Tizón Tardío de la Papa, Mexico • Pontificia Universidad Católica del Ecuador • PRECODEPA Programa Regional Cooperativo de Papa • SEAG Servicio de Extensión Agrícola y Ganadera, Paraguay • SEMTA Servicios Múltiples de Tecnologías Apropiadas, Bolivia • SENASA Servicio Nacional de Sanidad Agraria, Peru • SINITTA Sistema Nacional de Investigación y Transferencia de Tecnología Agraria, Peru • SPG Sociedad Peruana de Genética • TALPUY Grupo de Investigación y Desarrollo de Ciencias y Tecnología Andina, Peru • Universidad de Ambato, Ecuador • Universidad Austral, Chile • Universidad Católica de Santa Maria, Peru • Universidad Central, Ecuador • Universidad Central de las Villas, Cuba • Universidad Federal Rio de Janeiro, Brazil • Universidad Jorge Basadre Grohmann de Tacna, Peru • Universidad Mayor de San Simón, Bolivia • Universidad Nacional Agraria, Peru • Universidad Nacional de Cajamarca, Peru • Universidad Nacional del Centro del Peru–Huancayo • Universidad Nacional Daniel Alcides Carrión, Peru • Universidad Nacional Mayor de San Marcos, Peru • Universidad Nacional San Antonio Abad de Cusco, Peru • Universidad Nacional San Cristóbal de Huamanga de Ayacucho, Peru • Universidad Ricardo Palma, Peru • Universidad San Luis Gonzaga de Ica, Peru

International

• AKF Aga Khan Foundation, Switzerland • AVRDC Asian Vegetable Research and Development Center, Taiwan • CARE Cooperative for Assistance and Relief Everywhere, USA • CGIAR Consultative Group on International Agricultural Research, USA • CIAT Centro Internacional de Agricultura Tropical, Colombia • DECRG, Development Economics Research Group, World Bank, USA • FAO Food and Agriculture Organization of the United Nations, Italy • IAF Inter-American Foundation, USA • ICASA International Consortium for Agricultural Systems Applications, USA • ICIMOD International Centre for Integrated Mountain Development, Nepal • ICIPE International Centre for Insect Physiology and Ecology, Kenya • ICRAF International Centre for Research in Agroforestry, Kenya • ICRISAT International Crops Research Institute for the Semi-Arid Tropics, India • ICRW International Center for Research on Women, USA • IFPRI International Food Policy Research Institute, USA • IITA International Institute of Tropical Agriculture, Nigeria • ILRI International Livestock Research Institute, Kenya • IPGRI International Plant Genetic Resources Institute, Italy • ISNAR International Service for National Agricultural Research, Netherlands • Mountain Forum, USA • UNDP United Nations Development Programme, USA • WE World Education (and local partner NGOs) • World Vision, USA



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Deputy Director General for Research—Wanda Collins, PhD
Director for International Cooperation—Roger Cortbaoui, PhD

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Sor Lapouble, Auxiliary Services Assistant
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Martha Piérola, Social Worker, Supervisor
Lucero Schmidt, Nurse
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Yoner Varas, Compensation and Benefits Assistant

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Silvia Córdova, Bilingual Secretary
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Ximena Ganoza, Purchasing Supervisor
Atilio Guerrero, Vehicle Programmer
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Micheline Moncloa, Front Desk Supervisor
Antonio Morillo, Maintenance Supervisor
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Djordje Velickovich, Pilot
Saturnino Zapata, Electronic Technician[1]
Percy Zuzunaga, Pilot

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Raúl Blas, Research Assistant[2]
Giorgio Bollo, MS, Research Assistant[1,2]
Rolando Cabello, Agronomist, Research Assistant
Giselle Cipriani, Biologist, Research Assistant

*Project leader. [1]Joined during the year. [2]Left during the year. [3]Funded by special project. [4]Joint appointment.

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The CGIAR

"The CGIAR stands ready to move forward vigorously as a rededicated South–North enterprise capable of fulfilling a global vision of less poverty in the world; a healthier, better nourished, human family; reduced pressure on fragile natural resources; and people-centered policies for sustainable agricultural development."

—Ismail Serageldin, Chairman, CGIAR

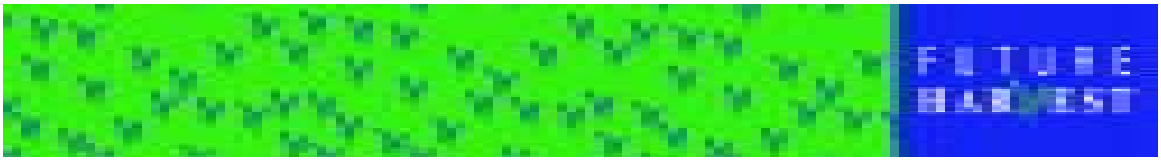
The Consultative Group on International Agricultural Research (CGIAR), established in 1971, is an informal association of 58 public- and private-sector members that supports a network of 16 international agricultural research centers. The CGIAR's budget for 1999 was funded at US$330 million. It is co-sponsored by the World Bank, the Food and Agriculture Organization of the United Nations, the United Nations Development Programme, and the United Nations Environment Programme.

The CGIAR's mission is to contribute to food security and poverty eradication in developing countries through research, partnership, capacity building, and policy support. It promotes sustainable agricultural development based on environmentally sound management of natural resources, focusing on five major research thrusts:

Increasing productivity in developing-country agriculture through genetic improvements in plants, livestock, fish, and trees, and through better management practices; **protecting the environment** through conservation of natural resources (especially soil and water) and reductions of the impact of agriculture; **saving biodiversity**, through one of the world's largest ex situ collections of plant genetic resources (over 500,000 accessions of more than 3,000 crop, forage, and agroforestry species), held in trust for the world community; **improving policies** that influence the spread of new technologies and the management and use of natural resources; **strengthening national research** in developing countries through partnerships with national programs and training in research techniques, administration, and management.

Future Harvest

Future Harvest raises awareness of the importance of science for food, the environment, and the world's poor. Based in Washington, DC, Future Harvest commissions studies to explore the links between food and agriculture and issues such as global peace, prosperity, environmental renewal, health, and the alleviation of human suffering. It also enlists public figures to become advocates for agricultural research, and informs decision-makers and the general public about the importance of food production and the role of agricultural science in meeting the human and environmental challenges of the 21st century. Created by the 16 Centers of the CGIAR, Future Harvest is supported by CIP and other research centers, donors to the CGIAR, foundations, and individuals.



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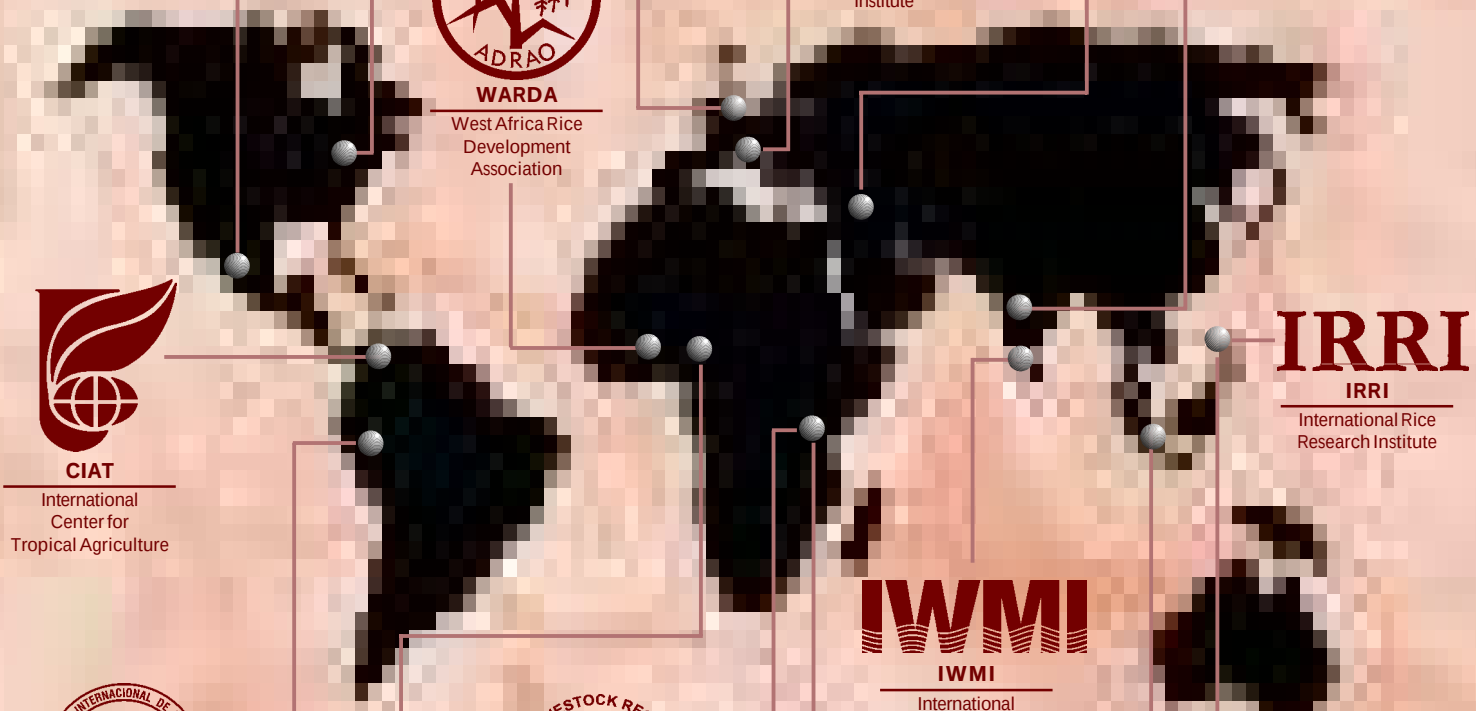

CIMMYT
International Center for the Improvement of Maize and Wheat

IFPRI
International Food Policy Research Institute

ISNAR
International Service for National Agricultural Research

WARDA
West Africa Rice Development Association

IPGRI
International Plant Genetic Resources Institute

ICARDA
International Center for Agricultural Research in the Dry Areas

ICRISAT
International Crops Research Institute for the Semi-Arid Tropics

CIAT
International Center for Tropical Agriculture

IRRI
International Rice Research Institute

IWMI
International Water Management Institute

CIP
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ILRI
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